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Los Alamos
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Ninth Quarterly Report – Three-Phase Centrifuge Control System

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Review

Los Alamos National Laboratory is working with Centech Inc. of Casper Wyoming to build an intelligent setup and control system for a three-phase centrifuge that was designed and is operated by Centech. Los Alamos is building a setup and control system that will make it possible for non-experts to operate the Centech machine. Currently, only Neal Miller, the inventor of the centrifuge, can operate the centrifuge in an optimal manner. With the intelligent control system less experienced operators will also be able to operate the centrifuge in a near optimal mode. Without the control system this "one operator" limitation reduces the potential impact that this centrifuge technology can have on US oil field and refinery environmental problems. The three-phase centrifuge is a portable device that is used for cleaning up oil field and refinery wastes. The centrifuge, in addition to supplying clean up services, recovers pipeline grade oil from the wastes. It therefore has the potential to help in a small way with the US energy supply problems also.

Accomplishments —fourth quarter-- FY01.

This is the ninth quarter of the project.

This quarter we were in the field with Centech three times. Two weeks were spent in Evanston Wyoming in July at the Chevron Painter Reservoir Unit. One week in September was spent in Cut Bank Montana, where Centech is working for CENEX. It appears that Centech will have about two months worth of work, in Cut Bank. Already Conoco, who is across the fence in Cut Bank has asked Neal to do some work with some of their tank bottoms. We will be back in Cut Bank near the end of October. Neal is also scheduled to go back to Evanston after he is finished in Cut Bank. This is provided that it is not to cold to split the waxy oil at the Painter unit when he finishes the Cut Bank work.

In Cut Bank all of the equipment worked well, even the heater, which we were having trouble with during our last visit to Evanston. The feed BS&W meter will probably need some recalibration. It seemed to read a little low on this trip. At this point we are not certain if there is some polymer in the feed that is staying in the meter and causing low BS&W readings or whether the meter has to be recalibrated for each different type of oil. Since the meter works with the conductivity of the oil-water mixture and water conducts and oil doesn't we assumed that the readings should be independent of the oil type. We still think so, but if calibration becomes part of the start up procedure we will include it.

There is quit a difference between the waxy gas condensate in Evanston and the "standard" tank bottoms in Cut Bank. This is just testimony that the Centech system can handle a wide variety of feedstock.

Since the system was working well, we were able to test some of our feed-forward control system. Basically we were able to test some of the soft sensors. So far the feed-forward soft sensors look pretty good in spite of the fact that we might need to recalibrate the feed BS&W meter. The soft sensors were built using our computer model of the feed system. We generated nearly 7500 data points in order to construct the rules and membership functions for these fuzzy soft sensors. Since we know that the computer model isn't perfect we are now fine-tuning the rules and membership functions with the real data. We are using this approach for two reasons.

- There are a large number of rules that would extend our expert beyond his limits. A computer program was written to fill in the "holes" in the information.
- The equipment and instrumentation hasn't worked well enough, up to this point, to allow us to do all of our development work through experiments.

We were able to test some of the soft sensors and it looks like only small adjustments will be needed. We were unable to test everything, since Neal had arrived in Cut Bank only the week before. He was up and running, but CENEX had supplied him with only a small amount of feed. Neal cleaned that material in a much shorter time than they had expected. He had to shut down while they used a hot-oiler to get oil from a 60,000 barrel tank to supply his feed tank. This should not be a problem when we go back later this month. We should be able to finish testing our feed forward control system.